Mars Gravity Field Modeling with MGS

William L. Sjogren
Dah-Ning Yuan
Alexander S. Konopliv

Jet Propulsion Laboratory,
California Institute of Technology,
4800 Oak Grove Dr., Pasadena, CA 91109
818-354-7549
dyuan@pop.jpl.nasa.gov

The first aerobraking phase (AB-1) of the Mars Global Surveyor (MGS) mission started after the Mars Orbit Insertion (MOI) on September 12, 1997, and lasted to the end of March 1998. During this period, no periapsis data were obtained because the spacecraft attitude prevented radio communication within ±30 minutes of periapsis. However, three months of periapsis tracking data have been collected during the two Science Phasing Orbits (SPO-1 and SPO-2 separated by one month of solar conjunction period). These data have periapsis altitudes of 170 km with periapsis latitudes varying from $65\deg$ N to $85\deg$ N and the orbital tracks spaced to provide good coverage in longitude. The second aerobraking phase (from the mid September of 1998 to the early February of 1999) accomplished orbit circularization without periapsis data as in AB-1. Three weeks of gravity calibration (February 4 - February 27) and one month in a frozen mapping orbit (March 1 - April 1) with a stowed High Gain Antenna will be the first opportunity of providing low altitude (~ 400 km) tracking data with global coverage.

The MGS tracking data will be incorporated with the historic tracking data of the Mariner 9, Viking Orbiter 1, and Viking Orbiter 2 to determine a 75th degree and order Mars gravity field model. The gravity solution using Surface Acceleration A Priori (SAAP) a priori, which provides constraints in the spatial domain, will be compared with the gravity solution using Kaula's a priori, which provides constraints in the spectral domain. The gravity anomaly maps over various regions of the Mars surface will be investigated. Statistical comparison and orbit fit evaluation will be shown as well as the error predictions using the formal covariance of the gravity solution. The gravity anomalies and their correlation with the topography derived from the Mars Orbiting Laser Altimeter (MOLA) will be displayed. There is definite resolution of the Hellas and Argyre basins and Hadriaca Patera as well as other surface features.